Program Standards and Matrix
INITIAL PROGRAMS IN SCIENCE EDUCATION

ND ESPB Standards	
13010.1 BIOLOGY The biology program requires study of zoology, botany, anatomy/morphology, physiology, genetics, ecology/environment, microbiology, cell biology/biochemistry, and evolution. This study includes: 1. laboratory and field experiences using a variety of living materials and instrumentation; 2. identification of biological phenomena; 3. characteristics of living organisms and their relationship with their physical and biotic environment; 4. interaction of biology and technology with the ethical and human implications; 5. general chemistry I & II with labs (8 semester hours minimum); 6. physics and earth science (4 semester hours each); 7. study of mathematics through the pre-calculus level (college algebra and above) and statistics.	

The program uses varied and authentic assessments of candidate's understanding and ability to apply that knowledge. Examples of performance assessments in which this content knowledge could be demonstrated appear in standards 13010.2 through 13010.10 which apply to all science education programs. **13020.1 CHEMISTRY** The chemistry program requires study of organic, inorganic, analytical, physical chemistry, and biochemistry. This study includes: 1. systematic and quantitative fundamentals of chemistry; 2. interaction of chemistry and technology and the associated ethical, environmental and human implications; 3. physics, biology, and earth science (minimum of 16 semester hours with at least four semester hours in each discipline); 4. study of mathematics through calculus (minimum of one semester of calculus) and statistics. The program uses varied and authentic assessments of candidate's understanding and ability to apply that knowledge. Examples of performance assessments in which this content knowledge could be demonstrated appear in standards 13020.2 through 13020.10 which apply to all science education programs.	

13035.1 EARTH SCIENCE The earth science program requires study including: 1. the interdisciplinary nature of earth and space science, including lithosphere, atmosphere, hydrosphere, space and their relationships to humans and the environment; 2. specialization in one of the earth and space sciences: astronomy, geology, meteorology, or oceanography; 3. minimum of eight semester hours in geology (physical geology with lab and historical geology with lab) 4. minimum of one semester each in astronomy and meteorology; 5. the impact of technologies on the lithosphere, atmosphere, and hydrosphere; 6. general chemistry I & II with labs (8 semester hours minimum); 7. physics and biology with labs (4 semester hours each); 8. study of mathematics through pre-calculus (college algebra and above) and statistics. The program uses varied and authentic assessments of candidate's understanding and ability to apply that knowledge. Examples of performance assessments in which this content knowledge could be demonstrated appear in standards 13035.2 through 13035.10 which apply to all science education programs.	

13047.1 COMPOSITE SCIENCE MAJOR/GENERAL SCIENCE The composite/general science program must include environmental science incorporated within other courses or as a separate course. The composite/general science program requires: 1. coursework in biology, chemistry, physics, and earth science, including: a. minimum of 24 semester hours in one area, b. minimum of 12 semester hours in two other areas, c. minimum of 4 semester hours in the fourth area, courses must be from those that the institution allows toward graduation in the science major; 2. study of mathematics through the pre-calculus level (college algebra and above) and statistics. The program uses varied and authentic assessments of candidate's understanding and ability to apply that knowledge. Examples of performance assessments in which this content knowledge could be demonstrated appear in standards 13047.2 through 13047.10 which apply to all science education programs. **13045.1 PHYSICAL SCIENCE** The physical science program requires: 1. coursework in chemistry and physics, with labs (minimum 15 semester hours in each discipline); 2. coursework in earth science (minimum 12 semester hours): 3. introductory biology (4 semester hours);	

4. laboratory and field experiences in the sciences; 5. study of mathematics through calculus (minimum of one semester of calculus) and statistics. The program uses varied and authentic assessments of candidate's understanding and ability to apply that knowledge. Examples of performance assessments in which this content knowledge could be demonstrated appear in standards 13045.2 through 13045.10 which apply to all science education programs. **13050.1 PHYSICS** The physics program requires: 1. systematic and quantitative study of physics including modern physics, mechanics, electricity & magnetism, thermodynamics, optics, and electronics (minimum 32 semester hours); 2. laws of physics and their application to various areas of physics and modern technology; 3. interaction of physics and technology with the ethical and human implications; 4. chemistry, biology, and earth science (minimum 16 semester hours; at least 4 semester hours in each area); 5. study of mathematics through calculus (minimum 2 semesters) including an introduction to differential equations.	

The program uses varied and authentic assessments of candidate's understanding and ability to apply that knowledge. Examples of performance assessments in which this content knowledge could be demonstrated appear in standards 13050.2 through 13050.10 which apply to all science education programs. **13010.2, 13020.2, 13035.2, 13045.2, 13047.2, 13050.2 NATURE OF SCIENCE** The program requires study of the history and philosophy of science as well as the interrelationships among the sciences. The program uses varied performance assessments of candidate's understanding and ability to apply that knowledge. **13010.3, 13020.3, 13035.3, 13045.3, 13047.3, 13050.3 INQUIRY** The program requires study of the processes of science common to all scientific fields. The program uses varied performance assessments of candidate's understanding and ability to apply that knowledge. These may include how to: • locate resources, design and conduct inquiry-based, open-ended investigations, interpret findings, communicate results, and make judgments based on evidence; • use listening and questioning strategies that encourage inquiry and probe for divergent student responses; • plan and implement data-based activities requiring students to reflect upon their findings, make inferences, and link new ideas to preexisting knowledge;	

• encourage productive peer interactions and plan both individual and small group activities to facilitate inquiry; • promote student use of scientific process, decision-making, and analysis skills for investigating science-related real-life problems. **13010.4, 13020.4, 13035.4, 13045.4, 13047.4, 13050.4 CONTEXT OF SCIENCE** The program requires the study of the effect of social and technological context on the study of science and on the application and valuing of scientific knowledge. The program prepares candidates to relate science to the daily lives and interests of students and to a larger framework of human endeavor and understanding. The program provides the candidate with an understanding of the relationship of science to industry, business, government, and multicultural aspects of a variety of communities. The program uses varied performance assessments of candidate's understanding and ability to apply that knowledge. **13010.5, 13020.5, 13035.5, 13045.5, 13047.5, 13050.5 SKILLS OF TEACHING** The program requires the candidate to demonstrate proficiency in methods of teaching science. The program uses varied performance assessments of the candidate's understanding and ability to apply that knowledge.	

13010.6, 13020.6, 13035.6, 13045.6, 13047.6, 13050.6 CURRICULUM The program provides candidates with information necessary to identify, evaluate, and apply a coherent, focused science curriculum that is consistent with state and national standards for science education and appropriate for addressing the needs, abilities and interests of students. The program uses varied performance assessments of candidate's understanding and ability to apply that knowledge. **13010.7, 13020.7, 13035.7, 13045.7, 13047.7, 13050.7 ASSESSMENT** The program prepares candidates to use a variety of performance assessment strategies to evaluate the intellectual, social, and personal development of the learner in all aspects of science. **13010.8, 13020.8, 13035.8, 13045.8, 13047.8, 13050.8 ENVIRONMENT FOR LEARNING** The program prepares candidates to design and manage safe and supportive learning environments in the classroom, laboratory, and field. The program reflects high expectations for the success of all students. The program uses varied performance assessments of candidate's understanding and ability to apply that knowledge.	

13010.9, 13020.9, 13035.9, 13045.9, 13047.9, 13050.9 PROFESSIONAL PRACTICE The program prepares candidates to participate in the professional community, improving practice through their personal actions, education, and development. The program uses varied performance assessments of candidate's understanding and ability to apply that knowledge. **13010.10, 13020.10, 13035.10, 13045.10, 13047.10, 13050.10 TECHNOLOGY** The program requires the study of current, appropriate instructional technologies. The program uses varied performance assessments of candidates' understanding and abilities to apply that knowledge.	